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[研究文章 Research Article]

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## 怪物大角鋏形蟲之飼養及棲地環境初探 (鞘翅目：鋏形蟲科)

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**摘要：**筆者在 2021 年 3 月澳洲新南威爾斯酒吧山步道 (Bar Mountain circuit) 的腐木下方採集到兩隻大角鋏形蟲屬 (*Lissapterus* Deyrolle, 1870) 的幼蟲，採集到的幼蟲在實驗室內以原生地腐殖質和腐朽的桉樹 (*Eucalyptus* sp.) 木材混合進行飼養，其中一隻幼蟲於 2022 年 1 月羽化為成蟲。透過形態比對，確認本種為怪物大角鋏形蟲 (*L. pelorides* (Westwood, 1855))，是澳洲東部新南威爾斯州和昆士蘭州交界處雨林帶的特有物種。另外，本研究也結合生物多樣性開放資料和地理資訊系統進行空間分析，提供本種野外棲地的基礎資訊。

**關鍵字：**大角鋏形蟲屬、鋏形蟲、人工飼養、地理資訊系統、空間分析

### 前言

大角鋏形蟲屬 (*Lissapterus* Deyrolle, 1870) 是澳洲特有的鋏形蟲屬別，目前已知 8 種 (Atlas of Living Australia, 2023)。牠們的足部短小，活動於森林底層且不會飛行，該屬雄蟲的大顎明顯彎曲且發達，一些種類的雄蟲在大顎內側靠近中央位置，會有一枚發達的內齒 (Hangay & de Keyzer, 2017)。雖然澳洲的大角鋏形蟲分類研究相當透徹，近期也有相關圖鑑書籍的出版 (Hangay & de Keyzer, 2017)，然而我們對於其人工飼養的知識仍然相當缺乏。2021 年 3 月 11 日，筆者在澳洲東部新南威爾斯州和昆士蘭州交界處的雨林區進行採集時，在邊界山脈國家公園 (Border Ranges National Park) 裡的酒吧山步道 (Bar Mountain circuit) 上，一根長約 2 m、直徑約 0.6 m 的腐朽木頭 (圖一 A) 正下方，發現兩隻鋏形蟲科的幼蟲，其中一隻為二齡幼蟲，另一隻為三齡，兩隻幼蟲皆棲息於腐木和地表交界處。

為了嘗試人工飼養的可能性和累積基礎生態資料，兩隻幼蟲皆被攜回研究室內進行飼養。成功羽化後的成蟲經 Hangay & de Keyzer (2017) 的圖鑑照片和形態描述等資訊，確認為怪物大角鋏形蟲 (*Lissapterus pelorides* (Westwood, 1855))。該物種的棲所主要為海拔 800m 以上的熱帶雨林及摩爾南青岡 (*Nothofagus moorei*) 為主的涼溫帶雨林，偏好棲息於大型堅硬木頭與地表的交界處 (Hangay & de Keyzer, 2017)。由於本物種的野外觀察資訊較為稀少，因此本研究利用生物多樣性開放資料和地理資訊系統 (Geographic Information System) 進行空間分析，歸納本種的生態棲地資訊。

### 材料與方法

兩隻幼蟲飼養於澳洲首都領地坎培拉市的澳大利亞國立昆蟲標本館 (Australian National Insect Collection, CSIRO, Canberra, ACT) 的實驗室內。兩隻幼蟲分別被放置於兩個 250 ml 的塑膠罐中，容器主要以適度濕潤的腐朽桉樹 (*Eucalyptus* sp.) 木材填充，該木材先前已放置於 -20 °C，並加入少許從原生地攜回之腐木屑，環境溫度介於攝氏 22-25 °C 間，飼養期間未更換過基質，並記錄下飼養細節，羽化後的成蟲則利用 Hangay & de Keyzer (2017) 的圖鑑照片和形態描述進行形態鑑定。

空間分析的部分利用澳洲生物多樣性網站「澳大利亞生命地圖集 Atlas of Living Australia (<http://www.ala.org.au>)」的物種分布點位資料與地理資訊圖層進行空間分析，歸類出怪物大角鋏形蟲在自然棲地偏好的年均溫度、年均雨量、海拔高度、植被類型、物種多樣性等環境資訊。圖層分別使用「WorldClim 2.1: Temperature - annual mean」、「WorldClim 2.1: Precipitation - annual」、「Elevation」、以及「Vegetation types - present」。由於怪物大角鋏形蟲屬於局部分布的稀有種類，本次採集位置的確切 GPS 位點不公開，空間分析則僅使用 Atlas of Living Australia 網站上已公開的分布點位資料。

## 結果

該二齡幼蟲在放入容器數週後，死亡於基質表面。三齡的幼蟲則順利成長，筆者於 2021 年 11 月 29 日觀察到幼蟲於容器底部建造蛹室(圖一 B)，蛹期約一個月，在 2022 年 1 月 4 日順利羽化，性別為雄性。根據 Hangay & de Keyzer (2017) 的圖鑑照片和形態描述等資訊，本個體鑑定為怪物大角鍬形蟲 (*Lissapterus pelorides* (Westwood, 1855)) (圖一 C)。空間分析基本與 Hangay & de Keyzer (2017) 敘述一致，根據 Atlas of Living Australia 網站上的分布資料，本種僅分布於新南威爾斯州和昆士蘭州交界處的雷明頓國家公園 (Lamington National Park) 和邊界山脈國家公園 (Border Ranges National Park) 境內(圖二 A)，空間分析顯示本種的天然棲地年均溫為攝氏 15~16°C (圖二 B)、年雨量約介於 1650~1800 mm 間(圖二 C)、海拔高度約為 500~900 m (圖二 D)，與植被資料圖層的套疊則顯示該地區的植被類型為雨林和藤本雜木林 (Rainforests and vine thickets) (圖二 E)。

此樣本為大型雄蟲，大顎內側中央有一枚大型齒突。怪物大角鍬形蟲與卵形大角鍬形蟲 (*L. ogivus* Bomans, 1986) 相似，但可藉由以下特徵區分：怪物大角鍬形蟲的軀幹較為粗壯、眼後緣較為突出、大顎腹面內側中央有一枚齒突、擁有大角鍬形蟲屬典型的前足脛節、和較為隆起的翅鞘 (Hangay & de Keyzer, 2017)。羽化後的成蟲以新鮮水果（如蘋果、西洋梨、白桃等）餵食，在實驗室飼養至同年 8 月底死亡。

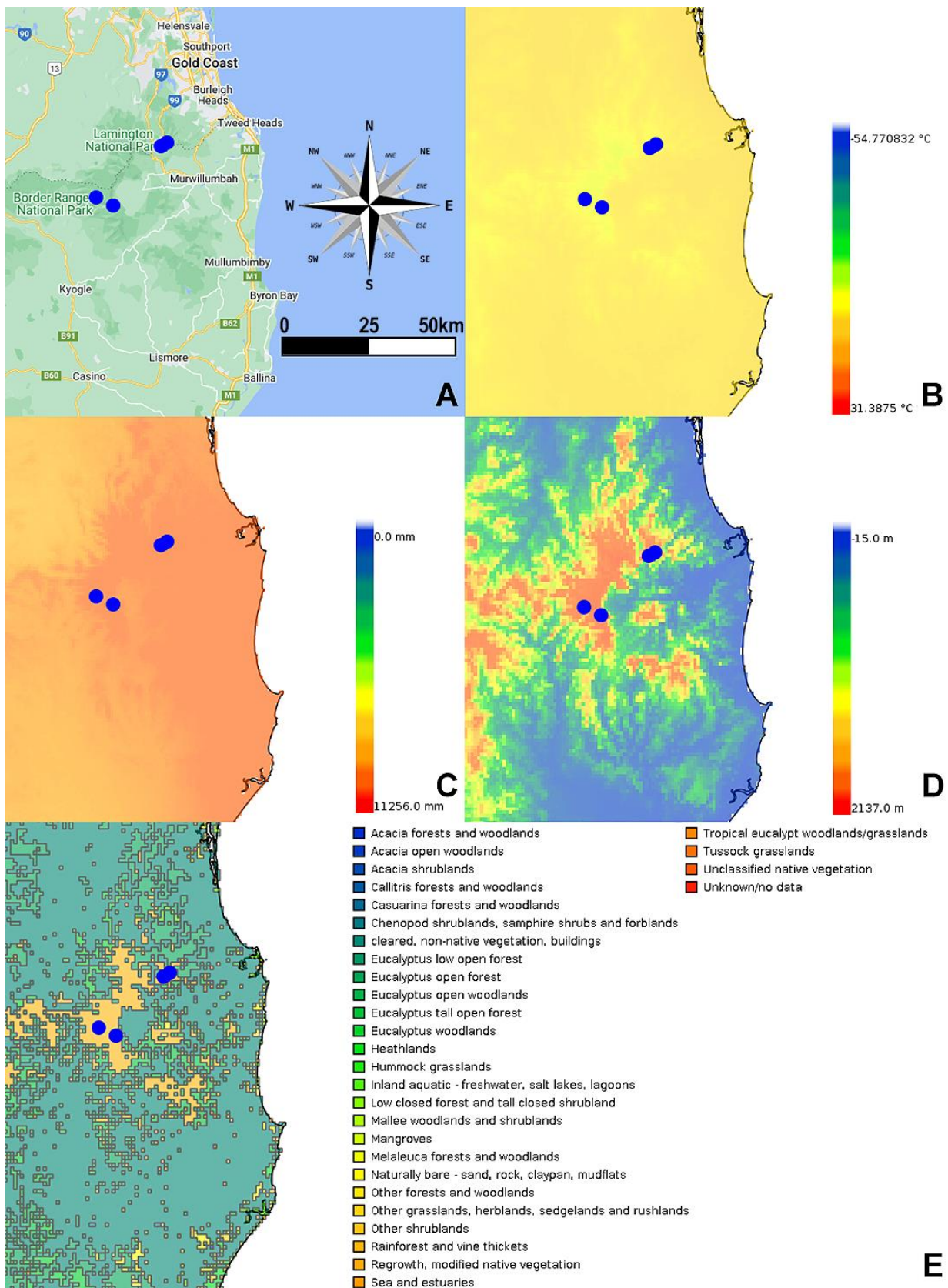
## 討論

從本次的實驗室飼養、野外觀察和空間分析中，總結出以下兩點討論：1) 較若齡的幼蟲似乎對人工飼養環境的適應力較差，而三齡的幼蟲適應得較好，最終順利成長為成蟲。鍬形蟲的幼蟲腸道含有共生酵母菌，這些酵母菌被認為能協助幼蟲從營養較為匱乏的朽木環境中獲取營養 (Haack & Slansky, 1987; Roets & Oberlander, 2020)，因此體型較大，體內擁有更多的共生酵母菌，就有可能較為強壯，而能適應人工飼養環境。然而本次飼養的個體數量僅有兩隻，較缺乏說服力，當然也有可能提供的朽木基質不適合大角鍬形蟲的幼蟲食用、環境溫度不適合 (空間分析顯示原產地年均溫攝氏 15 至 16°C 間)，或者幼蟲在長途運送過程中因受到濕度壓力、個體受傷、病菌感染等使幼蟲衰弱情況。除了未來對本屬的飼養研究應使用更多的個體樣本進行探究外，也應嘗試各種不同的腐朽程度朽木、朽木樹種、環境溫度來進行飼育；2) 本次成功羽化的大角鍬形蟲，從三齡到化蛹大約 9 個月。雖然不確定卵期和一、二齡幼蟲的成長時間，但近緣屬物種寬角鍬形蟲 (*Lissotes latidens* Westwood, 1871) 的飼養觀察紀錄 (Richards & Spencer, 2018) 顯示其幼生期至少可達兩年，因此推測怪物大角鍬形蟲的幼生期至少需時一年或甚至超過，且本次飼養溫度較野外年均溫高，可能野外生長速度又會更慢。大角鍬形蟲的生活史資料還需要未來更多的飼養測試和生態觀察紀錄。



圖一、A：怪物大角鍬形蟲幼蟲野外棲息環境；B：終齡幼蟲於飼養容器底部建造之蛹室；C：羽化後約一週的成蟲。





圖二、基於 Atlas of Living Australia 網站的生物多樣性開放資料和地理資訊系統所做的空間分析：A：怪物大角鋏形蟲的分布點位；B：與年均溫資料之套疊；C：與年雨量資料之套疊；D：與海拔高度圖層之套疊；E：與植被類型圖層之套疊。



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## Notes on Rearing and Natural Habitat of *Lissapterus pelorides* (Westwood, 1855) (Coleoptera: Lucanidae)

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**Abstract:** In March 2021, two larvae of *Lissapterus* Deyrolle, 1870, were collected beneath decaying wood along the Bar Mountain Circuit in New South Wales, Australia. The larvae were reared using a mixture of litter from their original habitat and soft wood from a decaying *Eucalyptus* tree under laboratory conditions. One of the larvae successfully pupated and emerged in January 2022. Morphological comparisons confirmed the species as *L. pelorides* (Westwood, 1855), which is endemic to the rainforest zone at the border of New South Wales and Queensland in eastern Australia. Moreover, spatial analyses were conducted based on the open-source biodiversity data and Geographic Information System to provide preliminary environmental information about the natural habitat of *L. pelorides*.

**Keywords:** *Lissapterus*, stag beetles, captive rearing, GIS, spatial analysis



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## New Records of the Ant Species *Tetramorium walshi* (Forel, 1890) (Hymenoptera: Formicidae) from Taiwan, with Additional Reports of *Tetramorium* Species from Penghu Islands

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**Abstract.** *Tetramorium* is a highly diverse ant genus with a worldwide distribution, and 10 species of this genus have been recorded in Taiwan. In this study, *Tetramorium walshi* (Forel, 1890) is reported from Taiwan for the first time, based on specimens collected from the Penghu Islands and Kinmen Islands. Additionally, three more *Tetramorium* species are reported from the Penghu Islands for the first time, accompanied by an identification key for the *Tetramorium* species found in this region. This study provides preliminary results on the investigation of the ant fauna of Taiwan's outlying islands, aiming to address the research gap on this underexplored topic.

**Keywords:** Formicidae, *Tetramorium*, Penghu Islands, Taiwan, Kinmen islands

### Introduction

The ant genus *Tetramorium* Mayr, 1855, commonly known as pavement ants, is a highly diverse myrmicine genus comprising 590 valid species and is distributed worldwide (Janicki et al., 2016; Guénard et al., 2017; Bolton, 2024). Generally, *Tetramorium* can be characterized by a combination of 11- or 12-segmented (mostly 12-segmented) antennae with an apically 3-segmented club, triangular mandibles with 2 or 3 apical teeth larger than the rest, a developed propodeal spine, and the lateral portions of the clypeus raised into a sharp ridge in front of the antennal insertions (Bolton, 1977; Terayama, 2009). In Taiwan, 10 species of *Tetramorium* have been recorded, including a former *Rhoptromyrmex* species, *Tetramorium wroughtonii* (Forel, 1902), which was transformed into *Tetramorium* several years ago (Terayama, 2009; Ward et al., 2015).

Currently, our understanding of the Formicidae fauna of Taiwan's outlying islands is limited, with only a few recent surveys conducted on the ant fauna of Taiwan's western outlying islands. For instance, *Dolichoderus sibiricus* Emery, 1889 was recorded from the Kinmen Islands (Hsu et al., 2017), and *Odontoponera denticulata* (Smith, 1858) was reported from Penghu Islands (Leong et al., 2017). During expeditions to Penghu Islands and subsequent specimen examinations from 2021 to 2022, I discovered a *Tetramorium* species distributed in Kinmen and Penghu Islands that is morphologically distinct from other Taiwanese members. After a detailed morphological comparison with Oriental *Tetramorium*, it was identified as *Tetramorium walshi* (Forel, 1890), representing a newly recorded species for Taiwan. Additionally, three other *Tetramorium* species collected by the author are reported from the Penghu Islands for the first time, and an identification key is also provided.

### Material and methods

The specimens were preserved in 95% alcohol and stored at -20°C after collection. They were subsequently mounted as dried specimens for further morphological examination. All voucher specimens were deposited in NTU (Department of Entomology, National Taiwan University, Taipei, Taiwan). Dried specimens were examined using a Leica S9D stereomicroscope, then photographed with a Leica Z16APO microscope equipped with a Leica DMC5400 CMOS camera, with images focus-stacked using LAS software (Version 4.13.0). Photos of living ants were taken in situ using a Nikon Z6 camera equipped with an AF-S VR Micro Nikkor 105mm F/2.8G lens. All figures were editing using Adobe Lightroom Classic and WPS Presentation as needed.



## Results

### Family Formicidae Latreille, 1809

### Subfamily Myrmicinae Lepeletier de Saint-Fargeau, 1835

### Genus *Tetramorium* Mayr, 1855

### *Tetramorium walshi* (Forel, 1890) 沃氏皺家蟻 (Fig. 1)

*Triglyphothrix walshi* Forel, 1890: 107.

*Triglyphothrix musculus* Forel, 1902a: 239.

*Triglyphothrix walshi spuria* Forel, 1912b: 58.

**Materials examined. TAIWAN:** [Kinmen Co.] 5 workers, Longkou (龍口), Jinning Township, 13. VII. 2021, Kai-Ti Lin leg. (NTU); [Penghu Co.] 21 workers, Xiwen Village (西文里), Magong City, 7. XII. 2022, Kai-Wei Chan leg. (NTU).

**Diagnosis.** *T. walshi* can be distinguished from other Oriental species by the combination of the following characters: Head, body, and appendages with uniformly dense trifid or quadrifid hairs; node of petiole in dorsal view distinctly broader than long and strongly compressed anteroposteriorly (Bolton, 1976). In Taiwan, *T. walshi* is most similar to *T. parvispinum* and *T. lanuginosum* in having branched hairs on the body but can still be differentiated by the aforementioned characters.

**Distribution.** Widely distributed in the Indomalayan region, including Taiwan (new record: Kinmen Islands and Penghu Islands), India, Sri Lanka, Bangladesh, Thailand, Vietnam, Peninsular Malaysia, China, Philippines, Sulawesi, Java, and the Lesser Sunda Islands (Janicki et al., 2016; Guénard et al., 2017).

**Remarks.** This species was found in both Kinmen Islands and Penghu Islands rather in the main island of Taiwan. Minor variation on the body color was found between individuals collected from different islands; specifically, individuals from Penghu tend to be darker. However, additional morphological differences was not observed. In Penghu, *T. walshi* was found to be sympatric with *T. lanuginosum* Mayr, 1870 and *T. smithi* Mayr, 1879, in expansive open lawns (Fig. 5A).

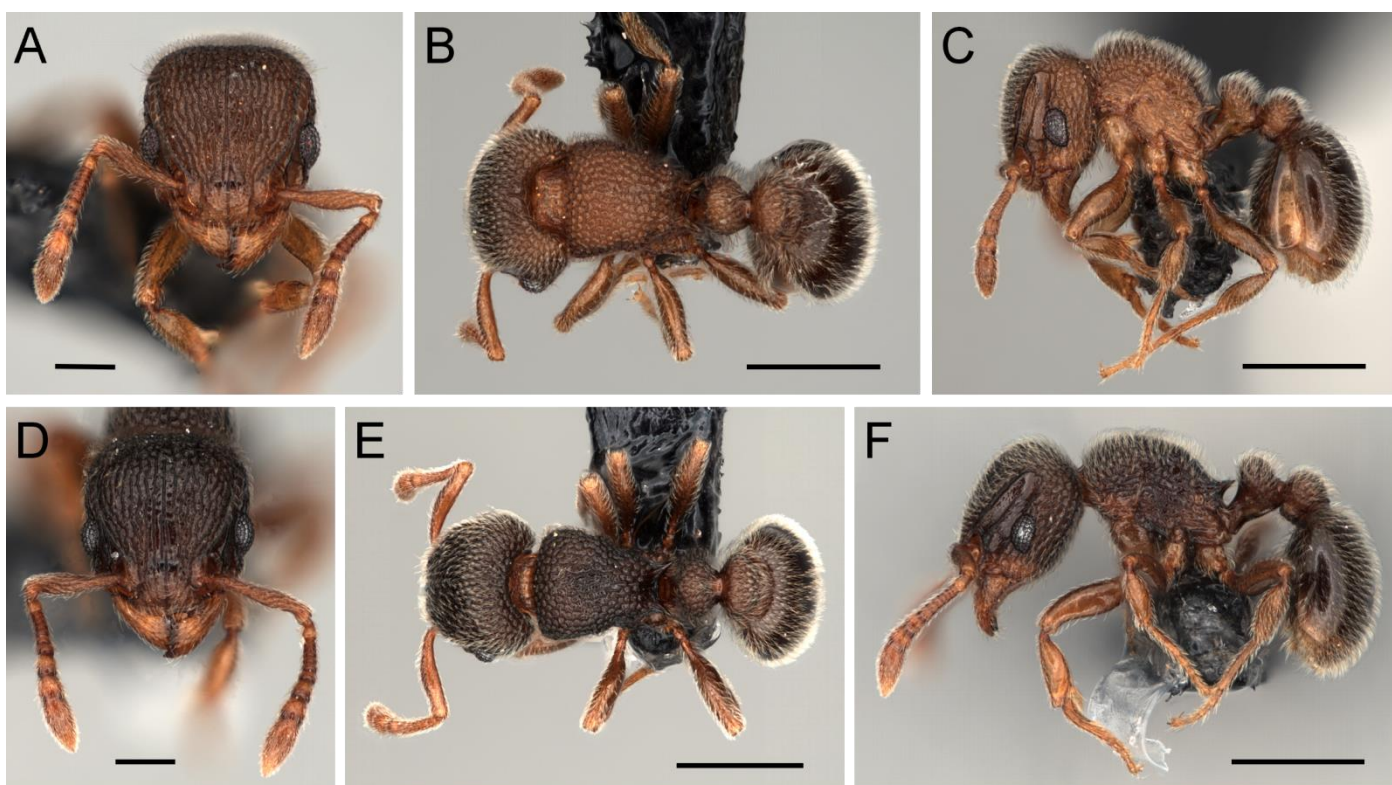


Fig. 1. The worker specimen of *Tetramorium walshi* (Forel, 1890). (A–C) Kinmen's specimen. (D–F) Penghu's specimen. (A, D) Head in frontal view, scale bar = 0.2 mm. (B, E) Dorsal view, scale bar = 0.5 mm. (C, F) Lateral view, scale bar = 0.5 mm.



*Tetramorium lanuginosum* Mayr, 1870 絨毛皺家蟻 (Fig. 2)

*Tetramorium obesum striatidens* Emery, 1889: 501.

*Triglyphothrix ceramensis* Stitz, 1912: 506.

*Triglyphothrix mauricei* Donisthorpe, 1946: 778.

*Triglyphothrix striatidens australis* Forel, 1902b: 449.

*Triglyphothrix striatidens felix* Forel, 1912a: 160.

*Triglyphothrix striatidens flavescens* Wheeler, 1929: 55.

*Triglyphothrix striatidens laevidens* Forel, 1900: 284.

*Triglyphothrix striatidens orissana* Forel, 1902a: 239.

*Triglyphothrix tricolor* Donisthorpe, 1948: 136.

**Materials examined. TAIWAN:** [Penghu Co.] 5 workers, Xiwen Village (西文里), Magong City, 7. XII. 2022, Kai-Wei Chan leg. (NTU).

**Distribution.** Widespread in tropical and subtropical parts of Asia, Australia, Africa, the Mediterranean, North America and the islands surrounding Oceania, Madagascar, the Galapagos, and the Eastern Caribbean (Wetterer, 2010).

**Remarks.** This species has long been considered a tramp species, likely originating from India and extending through tropical and subtropical East Asia to northern Australia (Wetterer, 2010). In Taiwan, it is a common species that prefers a dry environment.

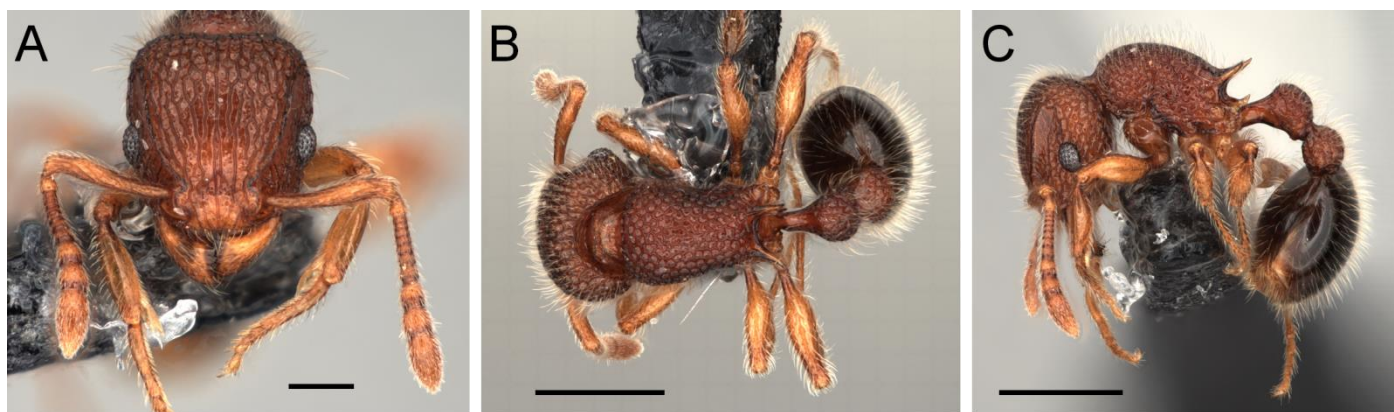


Fig. 2. The worker specimen of *Tetramorium lanuginosum* Mayr, 1870 collected from Penghu. (A) Head in frontal view, scale bar = 0.2 mm. (B) Dorsal view, scale bar = 0.5 mm. (C) Lateral view, scale bar = 0.5 mm.

*Tetramorium smithi* Mayr, 1879 史密皺家蟻 (Fig. 3)

*Tetramorium simillimum laevinode* Forel, 1902a: 235.

*Tetramorium smithi kanariense* Forel, 1902a: 703.

**Materials examined. TAIWAN:** [Penghu Co.] 2 workers, Xiwen Village (西文里), Magong City, 7. XII. 2022, Kai-Wei Chan leg. (NTU); 7 workers, Chima Village (赤馬村), Xiyu Township, 8. XII. 2022, Kai-Wei Chan leg. (NTU).

**Distribution.** Widespread in Indomalayan region, including India, Pakistan, Sri Lanka, Bangladesh, Laos, Thailand, Vietnam, China, Indonesia, Malaysia, Singapore, Philippines, Taiwan, Ryukyu Islands and several Micronesia Islands (Janicki et al., 2016; Guénard et al., 2017).

**Remarks.** Terayama (2009) recorded this species from Taiwan for the first time, but it is rarely encountered on the main island of Taiwan. I found that this species is relatively common in Penghu, where it inhabits grassland environments as a ground-dwelling ant. Additionally, the social carrying behavior of *T. smithi* between workers was observed for the first time (Fig. 5B).



Fig. 3. The worker specimen of *Tetramorium smithi* Mayr, 1879 collected from Penghu. (A) Head in frontal view, scale bar = 0.2 mm. (B) Dorsal view, scale bar = 0.5 mm. (C) Lateral view, scale bar = 0.5 mm.

*Tetramorium bicarinatum* (Nylander, 1846) 雙脊皺家蟻 (Fig. 4)

*Myrmica bicarinata* Nylander, 1846: 1061.

*Myrmica cariniceps* Guérin-Ménéville, 1852: 79.

*Myrmica kollari* Mayr, 1853: 283.

*Myrmica modesta* Smith, 1860: 108.

*Myrmica reticulata* Smith, 1862: 33.

**Materials examined.** TAIWAN: [Penghu Co.] 6 workers, Aimen Village (隘門村), Huxi Township, 7. XII. 2022, Kai-Wei Chan leg. (NTU).

**Distribution.** Widely distributed throughout tropical and subtropical regions of both the Old and New Worlds, including continental areas and islands surrounding Africa, the Caribbean, and Oceania (Wetterer, 2009).

**Remarks.** This species has long been recognized as a tramp species and is considered one of the most widely distributed ant species, presumably originating in the Indo-Pacific (Wetterer, 2009). In Taiwan, it is commonly found in various types of habitats. Unlike three other ground-living *Tetramorium* species in the Penghu Islands, *T. bicarinatum* was active on trees and was observed feeding on nectar (Fig. 5C).



Fig. 4. The worker specimen of *Tetramorium bicarinatum* (Nylander, 1846) collected from Penghu. (A) Head in frontal view, scale bar = 0.5 mm. (B) Dorsal view, scale bar = 0.5 mm. (C) Lateral view, scale bar = 0.5 mm.

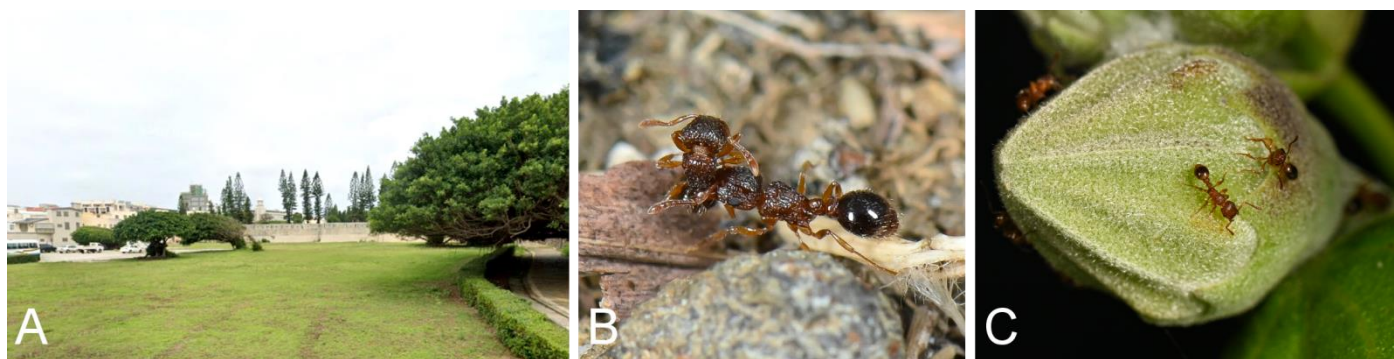


Fig. 5. (A) Habitat inhabited by *Tetramorium walshi*, *T. lanuginosum*, and *T. smithi*. (B) Social carrying behavior between workers of *T. smithi*. (C) *T. bicarinatum* feeding on nectar.

## Discussion

This study presents a preliminary investigation into the ant fauna of Taiwan's outlying islands, specifically the Penghu Islands, addressing a research gap in this underexplored area of myrmecology. Four *Tetramorium* species are recorded in Penghu: two tramp species with global distribution and two Indomalayan species. Among the Indomalayan species, *T. smithi* appears to be more abundant in the Penghu Islands compared to the main island of Taiwan. In contrast, *T. walshi* is found in the Penghu Islands but not on the main island of Taiwan, displaying a distribution pattern similar to that of *Meranophus bicolor* and *Odontoponera denticulata* (Wheeler, 1930b; Leong et al., 2017). These findings suggest the biogeographical significance and environmental uniqueness of the Penghu Islands, emphasizing the need for further myrmecological investigations of Taiwan's outlying islands.

### Key to *Tetramorium* species of Penghu Islands

#### 澎湖產皺家蟻屬物種檢索表

1. Hairs on head, mesosoma, and petiole abundant and with branched ones  
頭部、中軀與腹柄節上的體毛豐富，且具分岔的體毛.....2
- Hairs on head, mesosoma, and petiole sparse and not branched  
頭部、中軀與腹柄節上的體毛稀疏且不分岔.....3
2. Dorsal view of petiolar node not broader than long; Hairs on first gastral tergite sparse, either non-branched or bifid; Body bicolor, head and mesosoma brown to dark brown with blackish brown gaster.  
背面觀時，腹柄節瘤部寬度不大於長度；腹錘第一節背板上的體毛稀疏，不分岔或二分岔；體軀雙色，頭部與中軀褐色至深褐色，腹錘黑褐色。.....*Tetramorium lanuginosum* 絨毛皺家蟻
- Dorsal view of petiolar node apparently broader than long; Hairs on first gastral tergite abundant, either trifid or quadrifid; Body concolor, generally blackish brown.  
背面觀時，腹柄節瘤部寬度明顯大於長度；腹錘第一節背板上的體毛豐富，三分岔或四分岔；體軀同色，整體為黑褐色。.....*Tetramorium walshi* 沃氏皺家蟻
3. Antenna with 11 segments; Dorsal of petiole and postpetiole smooth and without sculpture.  
觸角 11 節；腹柄節與後腹柄節背部光滑無刻紋。.....*Tetramorium smithi* 史密皺家蟻
- Antenna with 12 segments; Dorsal of petiole and postpetiole sculptured.  
觸角 12 節；腹柄節與後腹柄節背部具刻紋。.....*Tetramorium bicarinatum* 雙脊皺家蟻

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## 沃氏皺家蟻於臺灣地區的新紀錄暨附澎湖產皺家蟻屬之補充紀錄

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**摘要:** 皺家蟻(*Tetramorium*)是一個全球廣布且物種多樣的屬，目前已在臺灣記錄到 10 個物種。本研究基於採集自澎湖群島和金門群島的標本，首次在臺灣地區記錄到沃氏皺家蟻(*Tetramorium walshi* (Forel, 1890))。此外，本研究還報導了三種皺家蟻在澎湖群島的新分布紀錄，並提供了澎湖地區皺家蟻屬的物種檢索表。這些發現為臺灣離島螞蟻相提供了初步的調查結果，以期填補離島螞蟻研究的空白。

**關鍵詞:** 蟻科、皺家蟻屬、澎湖群島、臺灣、金門群島



[研究文章 Research Article]

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## *Sympetrum parvulum* (Bartenev, 1913) (Odonata: Libellulidae): A Newly Recorded Dragonfly from Matsu Islands, Taiwan

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**Abstract:** The genus *Sympetrum* on Matsu Islands, Taiwan is summarized, and further records of *S. fonscolombii* (Selys, 1840) are provided. *Sympetrum cordulegaster* (Selys, 1883) and *S. depressiusculum* (Selys, 1841) are newly reported from the islands. Additionally, *Sympetrum parvulum* (Bartenev, 1913) is reported from Taiwan for the first time. The status of the *S. parvulum* in Taiwan is considered as an occasionally migrated record.

**Key word:** Dragonfly, vagrant dragonfly, migration, east Palearctic, Oriental, new record

### Introduction

The genus *Sympetrum* of Taiwan has been reviewed by Ma et al. (2022) in which ten species were recorded, including three resident species, three vagrant species, and four species that are either extinct or of unknown status. The Matsu Islands (Lienchiang County), located off the eastern coast of Fujian Province, share a similar fauna and flora with the mainland. Recent reports of new dragonfly records from the Matsu Islands indicate that the fauna of these islands remains poorly surveyed (Hu et al. 2023). Within the genus *Sympetrum*, only *S. fonscolombii* (Selys, 1840) has been reported from the islands (Ma et al. 2022). In the present paper, we summarize the current records of the genus on the Matsu Islands and report *Sympetrum cordulegaster* (Selys, 1883), *S. depressiusculum* (Selys, 1841) and *Sympetrum parvulum* (Bartenev, 1913) as newly recorded from the islands, with the latter is also being a new addition to the Taiwanese fauna.

### Materials and methods

The photos were taken using a Canon EOS R5 camera body with either an RF100mm f/2.8L MACRO IS USM lens or an RF100-500mm f/4.5-7.1L IS USM lens and subsequently edited in Adobe Photoshop CS5. The voucher specimens are deposited at the Taiwan Forestry Research Institute, Taipei, Taiwan (TFRI). In cases where the record was based only on photos, it is referred to in the section “Photo records”. The body length, abdomen length and hind wings length of *S. parvulum* were measured using an electronic digital vernier caliper.

### Results

#### 紅脈蜻蛉

#### *Sympetrum fonscolombii* (Selys, 1840)

**Material examination. TAIWAN: Lienchiang County:** 1 female, Nangan Township, Chenggongshan Cemetery (成功山民眾公墓), 26.1529, 119.9427, 30-IX-2023, leg. Lee et al. (TFRI).

**Photo records. TAIWAN: Lienchiang County:** 1 male, Nangan Township, 13-XI-2017, obs. C.-C. Hsu; 1 male, Dongyin Agricultural Research and Extension Station (東引農業改良場), 26.3598, 120.4853, 14-X-2020, obs. F.-S. Tseng.

### Distribution.

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Ma et al. (2022) summarized the distribution of this species in Taiwan; it is newly recorded from Dongyin Township.

### 長尾蜻蜓

*Sympetrum cordulegaster* (Selys, 1883)

**Photo records. TAIWAN: Lienchiang County:** 1 male and 1 female, Dongyin Agricultural Research and Extension Station (東引農業改良場), 26.3598, 120.4853, 14-X-2020, obs. F.-S. Tseng; 1 male, ditto, 24-IX-2023, obs. F.-S. Tseng.

#### Distribution.

Ma et al. (2022) summarized the distribution of this species in Taiwan; it is newly recorded from Lienchiang County.

### 秋紅蜻蜓

*Sympetrum depressiusculum* (Selys, 1841)

**Material examination. TAIWAN: Lienchiang County:** 1 male, Beigan Township, 26.2321, 119.9937, 28-IX-2023, leg. Lee et al. (TFRI).

**Photo records. TAIWAN: Lienchiang County:** 1 male, Dongyin Township, Dongyin Agricultural Research and Extension Station (東引農業改良場), 26.3598, 120.4853, 23-IX-2023, obs. F.-S. Tseng; 2 females, ditto, 24-IX-2023, obs. F.-S. Tseng; 1 male, Dongyin Township, Dongyin Command Museum (東引指揮部隊史館), 26.3643, 120.4937, 24-IX-2023, obs. F.-S. Tseng; 1 male and 1 female, Beigan Township, Wusha Reservoir (午沙水庫), 26.2193, 119.9841, 28-IX-2023, obs. Lee et al.; 1 male and 1 female, Nangan Township, Shengtian Marsh (勝天草澤), 26.1492, 119.9116, 30-IX-2023, obs. Lee et al.

#### Distribution.

Ma et al. (2022) summarized the distribution of this species in Taiwan; it is newly recorded from Lienchiang County.

### 姬紅蜻蜓

*Sympetrum parvulum* (Bartenev, 1913)

(Figs 1–2)

**Material examination. TAIWAN: Lienchiang County:** 1 male, Nangan Township, Shengtian Marsh (勝天草澤), 26.1492, 119.9116, 30-IX-2023, leg. Lee et al. (TFRI).

**Measurements.** Body length: 35.44 mm; abdomen length: 23.84 mm; hind wing length: 26.63 mm.

**Diagnosis.** In Taiwan, the species is similar to *S. eroticum ardens* (MaLachlan, 1894) and *S. cordulegaster* (Selys, 1883). The male can be distinguished from *S. eroticum ardens* by absence of distinct black spots on face, and from *S. cordulegaster* by lack of extended margin on abdominal segment VII.

**Habitat.** The male was found in a grassy pond adjacent to a secondary forest (Fig. 2). The pond was densely covered with Southern Cut Grass (*Leersia hexandra*) and Common Water Hyacinth (*Pontederia crassipes*) mixed with a few Narrow-leaved Cattail (*Typha angustifolia*).

#### Distribution.

The species is widely distributed in China (Henan, Hubai, Hunan, Guizhou, Chongqing, Fujian, Guangdong), Russia (Far East), Korea and Japan (Zhang, 2019; Ozono et al., 2022). It is reported from Taiwan for the first time in this study.

#### Comments.

In Japan and China, *S. parvulum* was regarded as a resident species, with no migration record has been reported (Zhang 2019, Ozono et al. 2022). Moreover, a mark-recapture experiment indicated that the species has a limited active range (Watanabe & Taguchi 1988). Despite multiple surveys in the same area, we found only find a single male, which we consider *S. parvulum* as an occasional vagrant from Fujian, China.





Figure 1. Male *Sympetrum parvulum* (Bartenev, 1913). A – dorsal habitus; B – lateral habitus; C – face; D – live photo.



Figure 2. Habitat of *Sympetrum parvulum* (Bartenev, 1913) on Matsu Islands.





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## 姬紅蜻蛉（蜻蛉目：蜻蛉科）：臺灣馬祖列島新紀錄蜻蛉

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**摘要:** 本文總結了臺灣馬祖群島的赤蜻屬 (*Sympetrum*) 分佈現況，並提供紅脈蜻蛉 (*S. fonscolombii*) 的新觀察紀錄。文中首次報導出現於馬祖群島上的長尾蜻蛉 (*S. cordulegaster*)、秋紅蜻蛉 (*S. depressiusculum*) 與姬紅蜻蛉 (*S. parvulum*)，其中姬紅蜻蛉為臺灣新紀錄，但被認為是偶然的遷徙紀錄。

**關鍵詞:** 蜻蛉、迷蜓、遷移、東古北區、東方區、新紀錄種



[研究文章 Research Article]

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## New Record of *Mictocommosis nigromaculata* (Issiki, 1930) in Taiwan with the First Host Plant Association for the Genus (Lepidoptera: Tortricidae, Archipini)

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**Abstract.** The type species of *Mictocommosis* Diakonoff, 1977, *M. nigromaculata* (Issiki, 1930), is recorded in Taiwan for the first time, with previously unknown generic host information uncovered as *Nekemias cantoniensis* (Vitaceae). The moth-plant distribution is largely matches based on the reference data, indicating the potential for similar host resources in other recorded countries.

**Keywords:** Oriental region, insect-plant interactions, Vitaceae

### Introduction

The genus *Mictocommosis* was established by Diakonoff (1977) under the tribe Hilarographini (Chlidanotinae) based on the Japanese type species, *Simaethis nigromaculata* Issiki, 1930. The current higher classification of this genus is placed in Archipini, based on the typically archipine-formed signum in the female genitalia (Heppner & Bae, 2015). The systematic position of this genus and related genera, i.e., the *Mictopsichia* group, has long been questionable, and the monophyly of *Mictocommosis* remains uncertain (Austin & Dombroskie, 2020). This genus tentatively includes six species, distributed across the Palearctic, Oriental, Afrotropical and Neotropical regions (e.g., Austin & Dombroskie, 2020).

In Taiwan, Heppner (2012) recorded the genus in the faunistic checklist for the first time and indicated that the Taiwanese population represents a new species, though no voucher specimen was provided. In 2019, the first author reared the agaristine species *Mimeusemia vilemani* Hampson, 1911, using its local host plant *Nekemias cantoniensis* (Vitaceae) collected in Academia Sinica, Taipei City, Taiwan, with a few parts of leaves rolled. Subsequently, a tortricid moth emerged in the rearing environment. This individual became the voucher specimen in the present study to elucidate the species-level identity of the Taiwanese *Mictocommosis*.

### Abbreviation

National Taiwan Museum, Taipei, Taiwan (NTM)

National Museum of Natural History, Washington, USA (USNM)

Laboratory of Systematic Entomology, Hokkaido University, Sapporo, Japan (SEHU)

### Material and methods

**Rearing** – A pinnately compound leaf of *Nekemias cantoniensis* (Vitaceae) was placed in a sealed bag (420\*280 mm) to originally provide food for a noctuid larva, *Mimeusemia vilemani* Hampson, 1911. A few leaves formed tubular structures, curling downwards from both sides; at least one of these was later confirmed to be a shelter constructed by a *Mictocommosis* larva during its immature stage before adult emergence.

**Genitalia preparations for morphological studies** – Genitalia were prepared following the general method described by Betts (1987) with slight modifications. After maceration of the abdomen in 10% KOH and subsequent cleaning, the female genitalia were carefully removed from the abdomen, and abdominal segments 1–6 were opened along the caudocephalic axis from the right side.

## Results

### *Mictocommosis nigromaculata* (Issiki, 1930) 漣波鑽捲蛾 (首次建議中文名) (Fig. 1)

*Simaethis nigromaculata* Issiki, 1930: 423. (Type information: Holotype: ♀, Japan, "Honshu, Osaka Prefecture, Mt. Iwawakisan". (USNM))

*Simaethis takaonis* Matsumura, 1931: 1081. (Type information: Holotype: ♀, Japan. "Honshu, Tokyo Prefecture, Mt. Takao". (SEHU))

*Anthophila nigromaculata*: Issiki, 1957: 33, fig. 131.

*Mictocommosis nigromaculata*: Diakonoff, 1977: 9, figs. 2, 5-7; Kuznetsov, 2000: 341; Nasu, 2013: 197, fig. 4-23-6.

**Specimens examined.** 1 ♀, TAIWAN, Taipei City, Nangang, Academia Sinica, 23. VI. 2019, reared from *Nekemias cantoniensis*, emgd. 7. V. 2019, SWUBR2019-100, leg. S. Wu (NTM).

## Diagnosis

The Taiwanese female individual (Fig. 1b, d) shows no remarkable difference in appearance compared to the specimen from the type locality in Japan (Fig. 1a, c). The female genitalia of the Japanese and Taiwanese specimens are quite similar, except that the signum in our examined Taiwanese specimen is somewhat damaged and the basal sclerotized plate is more slender. Unfortunately, no scale bar is available for the former, preventing morphometric comparison between the two specimens. In Taiwan, this species can be easily identified by the ocelloid patches present on the forewing. In addition, the hindwing of this species is dark greyish brown basally with orange blotches medially and peripherally, which distinguishes it from other congeners.

## Description

Female (Fig. 1b). Antenna length 1.96 mm (n = 1), forewing length 6.17 mm (n = 1). Head: antenna orange brown, gradually darker toward apex; vertex with rough scales, creamy. Thorax: surface orange, with a metallic indigo stripe medially, tegula orange, with a metallic indigo stripe at inner side. Forewing: ground color orange, brighter near base, slightly darker near termen; costa roughly curved; costal fold absent; basal patch with one incontinuous metallic indigo stripe near costa, extended toward basal 1/4 costa, sharply curved toward dorsum, end at middle half, two short metallic indigo stripes presented, one parallel to costa, one vertical to dorsum; a wide metallic indigo stripe started at middle costa, extended toward dorsal 1/3 of termen, but not reached; a metallic indigo stripe started at 1/5 costa near apex, extended toward half of termen; a small metallic indigo spots near apex; an ocelloid patch presented near tornus, ground color black, scattered with some orange spots at basal 3/4, two metallic indigo blotches at distal 1/4, two beige spots presented medially, one near costa, one near dorsum; dorsal 2/3 of forewing scattered with some metallic silver scales; fringes greyish white, dark greyish mesally, inner cilia dark orange. Hindwing: ground color dark greyish brown; some orange blotches presented on middle of hindwing and along termen and dorsum; an unobvious ocelloid patch presented at tornus, with a metallic indigo stripe.

Female genitalia (Fig. 1d). Anal papillae oblong, anterior apophyses slender; lengths of anterior and posterior apophyses similar; ductus bursae long, curved near anterior half; corpus bursae nearly cylindrical and membranous, sigum a tortricoidal horn, somewhat broken in our examined specimen, a basal sclerotized plate slender.

## Host plant

To date, no references have identified the host plant of *Mictocommosis*. For example, Nasu (2013) noted the host of this species as "unknown". The present study confirms *Nekemias cantoniensis* (Vitaceae) as the host plant of this species.

## Distribution

Japan, Korea (Byun, 2020), Vietnam (Kuznetsov, 2000), China (Wang et al., 2017) and Taiwan (the present study).

## Chinese vernacular name

The suggested Chinese vernacular names for the genus and the type species are proposed here as 漣波鑽捲蛾屬 for the genus and 漣波鑽捲蛾 for the type species, respectively.

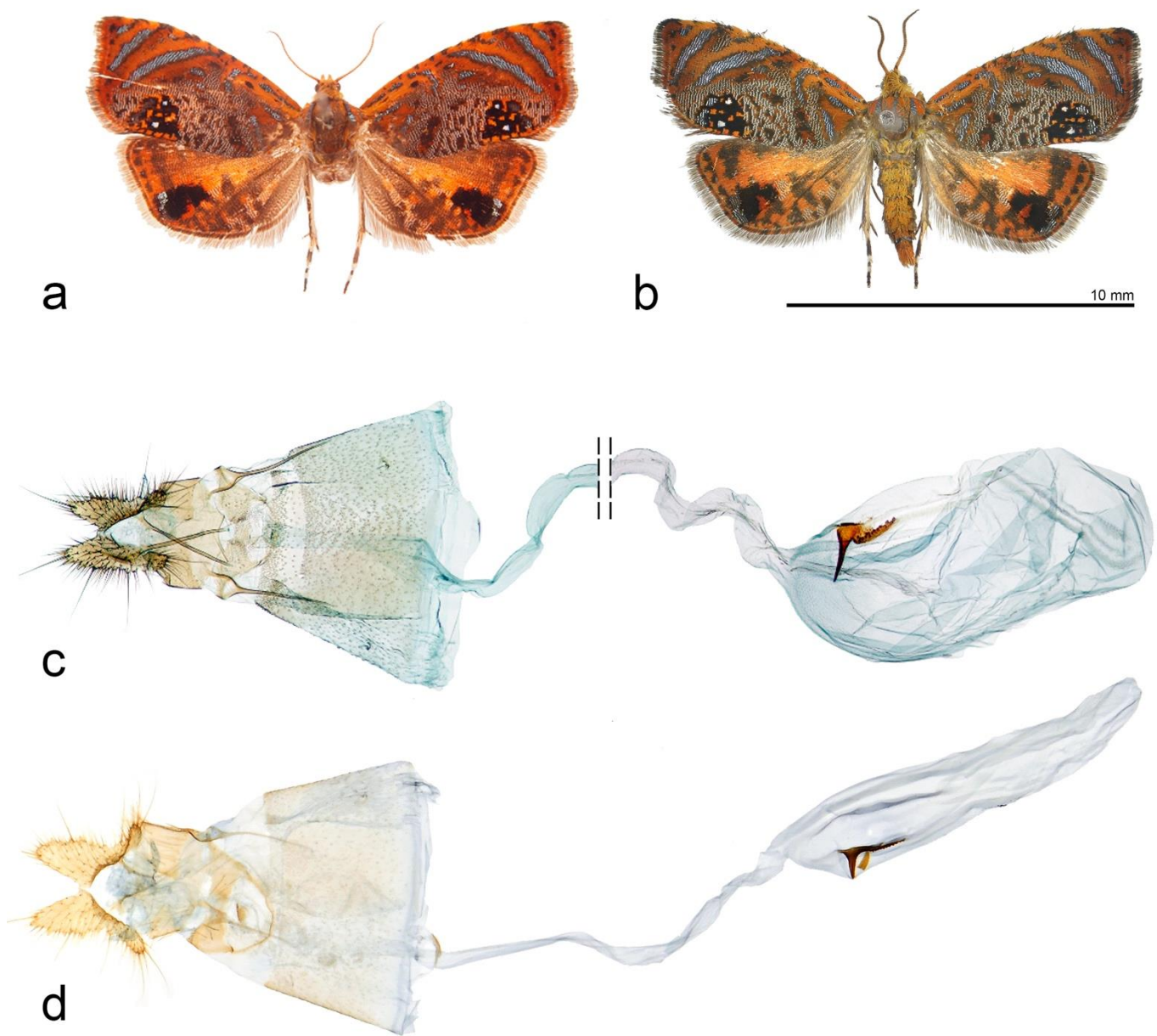


Figure 1. *Mictocommosis nigromaculata* (Issiki, 1930). a. female specimen, Japan; b. *Ditto*, Taiwan. (NTM); c. Female genitalia, Japan; d. *Ditto*, Taiwan (NTM). Courtesy of specimens: Collection of Yoshitsugu Nasu (a, c); NTM (b, d). Photos by Yoshitsugu Nasu (a, c); Shipher Wu (b, d). Scale bar = 10 mm (b).





## Discussion

According to Plants of the World Online (2024), the host plant *Nekemias cantoniensis* has a distribution that largely overlaps with the known distribution of *Mictocommosis nigromaculata* in Japan, Taiwan, China and Vietnam, except for the Korean peninsula. The overlapping distribution between the moth and its host plant suggests the possibility that some of the other populations outside of Taiwan may select the same host plant. Further study is needed to confirm the immature biology.

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## 連波鑽捲蛾於臺灣的首次記錄與確認其屬級寄主植物關聯（鱗翅目：捲蛾科：黃捲蛾族）

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**摘要：**本文章首次紀錄連波鑽捲蛾屬(*Mictocommosis* Diakonoff, 1977)的模式種連波鑽捲蛾(*M. nigromaculata* (Issiki, 1930))於臺灣的分布，並確認此前未知的寄主植物為廣東山葡萄(*Nekemias cantoniensis*, 葡萄科)。根據現有資料，此蛾種與寄主植物的分布大致相符，顯示蛾種在其他已記錄國家可能利用類似的寄主資源。

**關鍵字：**東方區、交互作用、葡萄科

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